

interesting information as to the progress of the thirteen topographical parties, the two *Mousawwar*, or village survey parties, and the six cadastral or field survey parties, whose duties now include, as an experiment, the recording of particulars about each field; thus reducing the cost of preparing the "Record of Rights" for the Board of Revenue. The geographical reconnaissance and trans-Himalayan explorations are replete with curious information to every student of nature, and of the habits and customs of the frontier hill tribes and peoples. The perusal of this report increases, if possible, our good opinion of the skill and devotion to duty of the several officers, and of the marked ability of the administration of this department by General Walker, and which it is most pleasing to find so handsomely acknowledged by the Government of India.

ZOOLOGY AND BOTANY OF ALASKA¹

THE United States Revenue cutter *Corwin* went on a cruise in 1881 to Alaska and the Arctic Ocean. The main object of the voyage was to search the various accessible portions of the Arctic coasts for traces of the *Jeannette* and two missing whaling vessels which were lost the same season that the *Jeannette* entered the ice. Leaving St. Michael's on June 21, Behring's Sea was crossed to St. Lawrence Island and Plover Bay on the Siberian coast; then the *Corwin* went along this coast through the Straits and north-west to the vicinity of Nordenskjöld's winter quarters, where a sledge party, which had been left there earlier in the season to search the coast in that district, was taken on board; it then returned to St. Lawrence Island and St. Michael's. After a short delay it again proceeded to the Arctic, touching at all the islands in Behring's Straits, visiting in succession the entire Alaskan coast line from Behring's Straits to Point Barrow, including Kotzebue Sound, and on the Siberian shore from the Straits to North Cape. It also cruised along the edge of the ice pack, visiting Herald and Wrangel Islands—almost unknown masses of land—and, returning homewards, some time was spent at Ounalaska in the Aleutian Islands fitting for the voyage to San Francisco, which was reached in October.

As one of the results of this cruise, we have a series of notes and memoranda, medical and anthropological, botanical and ornithological, published by order of the House of Representatives at Washington.

The medical and anthropological notes of Alaska are by Dr. Irving C. Rosse. The health of the ship's crew was fairly good throughout the voyage, very careful precautionary measures being observed: for the usual habit of deluging the decks above and below every morning with water, a system of scraping and dry scrubbing was substituted with excellent results, and the decks were only wetted once or twice a month on fine days. Good water was procured nearly everywhere in the Arctic, and it is noted as of unusual excellence at Cape Thompson and at Herald and Wrangel Islands. The weather was mostly wild, with snow and hail; in the latter part of June at St. Michael's the sun was found almost overpowering, although the thermometer registered but 60°. Dr. Rosse gives a sketch of the diseases peculiar to the aboriginal population, especially of an epidemic of pneumonia which prevailed at Ounalaska. He declares "that there is an absolute consensus of opinion both among the executive and medical officers of late Arctic expeditions in regard to the judicious use of alcoholic beverages," and that though himself of abstemious habits, yet the facts observed "warrant him in testifying to the undeniable good effects of whisky when served out to the crew after

unusual fatigue and exposure." On reaching St. Lawrence Bay, Siberia, a native speaking a little English was at his own request taken on board; the bustle and stir brought on a state of sleeplessness, and his state of mind was not improved on seeing the collection of skulls on board, nor by the chaff of the fore-castle men, who tried to persuade him he was to be brought to San Francisco as an anatomical curiosity. As a result he stabbed himself dangerously in the left chest, and then leaped overboard; a boat being alongside, he was promptly rescued. The knife was found to have entered several inches, and blood and air were escaping from the wound. The symptoms were such that, writes Dr. Rosse, "the patient ought to have promptly perished, notwithstanding the treatment," but in a few days the patient was landed at Plover Bay, where he recovered sufficiently to start on foot for his home over a rugged mountain way 150 miles distant. "Wounds seem to heal uncommonly well in the Arctic, a fact doubtless owing to the highly ozonised condition of the atmosphere, and the absence of disease germs and organic dust."

Dr. Rosse's anthropological notes on the natives met with are of some importance, though his conclusions based on these may not always be acceptable. Referring to the prevalence of tattooing among the Esquimaux women, he gives a figure of strange design seen on the cheeks of a woman of St. Lawrence Island. Some drawings of crania are given, but we have failed to find any detailed account of them.

The botanical notes on Alaska are by John Muir. There is no line of perpetual snow on any portion of the Arctic regions known to explorers. Every summer the snow disappears not only from the low sandy shores and boggy tundras, but also from the mountain tops; for nearly three-fourths of the year the plants lie buried under it, but they awake up in June and July to a vigorous growth, and on the drier banks and hills about Kotzebue Sound, Cape Lisbourne, and elsewhere, many species show but little climatic repression, growing during the long summer's day tall enough to wave in the wind, and to unfold a rich profusion of flowers. A list of the species found at the following localities is given—St. Michael's, Golovin Bay, Kotzebue Sound, and Cape Thompson, where a new species of *Erigeron* was found (*E. muirii*, Gray). On Herald Island sixteen species of flowering plants were gathered. At Wrangel Island, from an area of about half a square mile, twenty-seven species of flowering plants were collected; they all occurred in separate tufts, leaving the ground between them bare and raw as that of a newly ploughed field. Some portions of the coast, however, farther south, presented a greenish hue, as seen from the ship, at a distance of eight or ten miles, owing no doubt to vegetation growing under less unfavourable conditions than at the point the *Corwin* touched at.

The birds of Behring's Sea and the Arctic Ocean are described by Mr. E. W. Nelson; many of the breeding quarters of North American birds are given, and details are also added of some of the rarer forms met with. A fine adult male Siberian Wagtail (*Motacilla ocularis*, Swinhoe) was taken at Plover Bay the last day of June; it was in perfect breeding plumage. A specimen of *Lanius cristatus* was picked up dead on Wrangel Island. Strictly an Asiatic bird, it must have reached this distant spot during some storm, and died of starvation or exposure. A fine adult female, in breeding plumage, of *Eurynorhynchus pygmaeus*, was taken at Plover Bay, and several others were seen. A specimen of *Rhodostethia rosea* in immature plumage was obtained at St. Michael's, and reference is made to three fine specimens secured by Mr. Newcomb during the drift of the *Jeannette*, which are now in the Smithsonian collection, one of which still retains its extremely rich peach-blossom pink so characteristic of this the most beautiful of the gulls.

¹ "Cruise of the Revenue Steamer *Corwin* in Alaska and the North-West Arctic Ocean in 1881. Notes and Memoranda, Medical and Anthropological, Botanical and Ornithological." (Washington: Government Printing Office, 1883.)

A list of the fishes known to occur in the Arctic Ocean, north of Behring's Straits, by Tarleton H. Bean, is appended. The list is based exclusively upon specimens in the United States National Museum, and is acknowledged to be incomplete; it only contains twenty-one species, eight others being added as "properly belonging to the fauna." No details beyond the localities where found are given.

SOUND-MILLS

AFTER the notable researches of Crookes on radiation, which culminated in the discovery of the radiometer, or light-mill, it was a natural transition of thought which suggested to several minds almost simultaneously the possibility of devising an apparatus which should rotate under the influence of sound-waves as does the radiometer under the influence of the rays of light and heat. Such instruments were indeed devised independently about six years ago by Lord Rayleigh, by Prof. Alfred M. Mayer of Hoboken, by Mr. Edison, the well-known inventor, by Prof. Mach of Prague, by Dr. A. Haberditzel of Vienna, and by Prof. V. Dvorák of the University of Agram (in Croatia). These researches, though of great scientific interest, have been somewhat overlooked in the rush of scientific inventions during the intervening years. During the course of the past year,

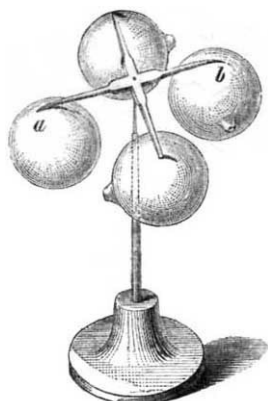


FIG. 1.

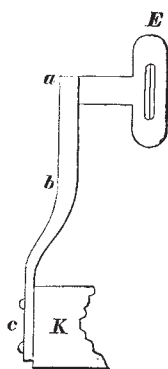


FIG. 2.

however, Dr. Dvorák has given to the world, in the pages of the *Zeitschrift der Instrumentenkunde* (vol. iii. Heft 4), a detailed account of his experiments, together with figures of various pieces of apparatus hitherto undescribed. We propose to give a *résumé* of the principal points of Dvorák's researches.

Four kinds of sound-mills are described by Dvorák, two of them depending on the repulsion of resonant-boxes or cases, and two others on different principles.

The first of these instruments is depicted in Fig. 1, and consists of a light wooden cross, balanced on a needle point, carrying four light resonators made of glass. These resonators are hollow balls of 4.4 cms. diameter, with an opening of 0.4 cm. at one side. They respond to the note g' (= 392 vibrations). When the note g' is forcibly sounded by an appropriate tuning-fork, the air in each of the resonators vibrates in response, and the apparatus begins to rotate. As a resonator will respond when placed in any position with respect to the source of sound, it is clear that one single resonator properly balanced should rotate; and this is found to be the case, though, naturally, the action is more certain with four resonators than with one.

Before proceeding to the other forms of sound-mill devised by Dvorák, it may be well to explain briefly the cause of the phenomenon, and to describe Dvorák's

particular method of exciting the appropriate sound. Dvorák has pointed out, as indeed has been done elsewhere both by Lord Rayleigh and by Prof. A. M. Mayer, that, when sounds of great intensity are produced, the calculations which are usually only carried to the first order of approximation cease to be adequate, because now the amplitude of motion of the particles in the sound-wave is not infinitely small as compared with the lengths of the sound-waves themselves. Mathematical analysis shows that under these circumstances the mean of the pressures in the condensed part and in the rarefied part of the sound-wave is no longer equal to the undisturbed atmospheric pressure, but is always greater. Consequently at all nodal points in the vibrations of the air in tubes or resonant-boxes the pressure of the air is greater than elsewhere; and therefore any resonator closed at one side and open at the other is urged along bodily by the slight internal excess of pressure on the closed end. The apparatus, Fig. 1, therefore rotates by reaction, in the same way as Hero's primitive steam-engine rotated, though the reaction is due to a different cause.

To produce vibrations of sufficient intensity Dr. Dvorák employs heavy tuning-forks mounted on resonant-cases, and excited electrically. For this purpose he places between the prongs of the fork an electromagnet constructed on the following plan. Two plates of iron separated by a sheet of paper are used as a core. They

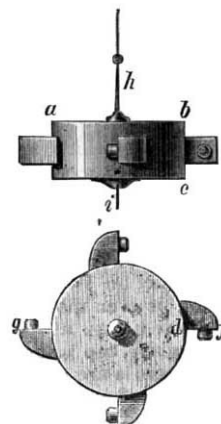


FIG. 3.

are cut of such a breadth as to lie between the prongs without touching them. This core is overwound with insulated copper wire, as shown at E, Fig. 2, and the electromagnet is then mounted by a bent piece of wood, *abc*, upon the sounding-box, *K*, of the fork. The wires are connected in a circuit with a battery, and with the electromagnet of a self-exciting tuning-fork of the same note. Dr. Dvorák is extremely particular about the arrangements of the resonant-boxes of his tuning-forks. They must not touch the table, the arm *abc* being clipped at about the point *b* in a firm support. Moreover the resonant-boxes themselves require to be specially tuned, for all are not equally good. Dr. Dvorák points out that, beside the tone of the fork, and the tone of the air column in the cavity of the box, there is also a tone proper to the wood of the box itself, which in most of the forks used in acoustic researches is too base, the wooden walls being too thin. To hear this tone the prongs of the fork should be damped by sticking a cork between them, and the cavity should be filled with cotton-wool, while the wooden box is gently struck with the knuckle or with a cork hammer. It is important that the wood-tone should be tuned up to coincidence with the tone of the fork and with that of the air in the cavity. Dr. Dvorák himself used the box depicted further on in Fig. 6, in which drawing F is the socket into which the stem of the fork